ABSTRACTS

Third Cotton Utilization Research Conference

May 2 and 3, 1963

Southern Utilization Research & Development Division

Agricultural Research Service

U. S. DEPARTMENT OF AGRICULTURE

1100 Robert E. Lee Blvd.
New Orleans, Louisiana

ABSTRACTS

Third Cotton Utilization Research
Conference

May 2 and 3, 1963

This report summarizes the discussions of the various speakers during the conference. If further details regarding any particular subject are desired, they may be obtained by communicating with the person concerned.

C. H. Fisher, Director

Southern Utilization Research and Development Division

THIRD COTTON UTILIZATION RESEARCH CONFERENCE

HONORARY CHAIRMAN

Sydney M. Cone, Jr.

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UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Third Cotton Utilization Research Conference

May 2-3, 1963

PROGRAM

Jung Hotel - Tulane Room
Thursday, May 2, 1963

8:30 A.M. - Registration

9:00 A.M. - Introduction	E. L. Patton Assistant Director Southern Utilization Research and Development Division
Welcome	C. H. Fisher Director Southern Utilization Research and Development Division
Opening Remarks	Sydney M. Cone, Jr. Cone Mills Corporation Greensboro, North Carolina
Need for Research	Otto Goedecke Otto Goedecke, Inc. Hallettsville, Texas

Presiding: Fred B. Dent, Mayfair Mills, Arcadia, South Carolina

Effect of Structure on the Properties of Stretch-Type Cotton Yarns
George F. Ruppenicker and John J. Brown
Cotton Mechanical Laboratory
Southern Utilization Research & Development Division

Improving Cotton Cleaning Efficiency with the SRRL Fiber Retriever
August L. Miller and Roger S. Brown
Cotton Mechanical Laboratory
Southern Utilization Research & Development Division

Improved Techniques for Evaluating Spinning Performance of Cottons
Louis A. Fiori and Gain L. Louis
Cotton Mechanical Laboratory
Southern Utilization Research & Development Division

Effect of Fiber Length Distribution and Spinning Variables on Yarn Properties and Spinning Performance
Gain L. Louis, Louis A. Fiori, Herschel W. Little, and Lorraine A. Leitz
Cotton Mechanical Laboratory
Southern Utilization Research & Development Division

Discussion — W. M. Pittendreigh, Moderator
Riegel Textile Corporation
Ware Shoals, South Carolina

12:30 P.M. LUNCHEON

1:30 P.M., Thursday, May 2, 1963

Presiding: Robert F. Schwenker, Jr., Textile Research Institute, Princeton, New Jersey

Changes in Certain Structural and Mechanical Properties of Cotton Cellulose with High Progressive Acetylation
C. M. Conrad, P. Harbrink, and A. L. Murphy
Plant Fibers Pioneering Research Laboratory
Southern Utilization Research & Development Division

New Triazone Finishes for Cotton Wash-Wear
Sidney L. Vail
Cotton Finishes Laboratory
Southern Utilization Research & Development Division

Post-Irradiation Reactions of Cotton Cellulose
Florine A. Blouin and Jett C. Arthur, Jr.
Cotton Chemical Reactions Laboratory
Southern Utilization Research & Development Division

Effects of Tension in Crosslinking Treatments of Cotton Fabrics
R. S. Orr, J. J. Hebert, L. C. Weiss, and J. N. Grant
Cotton Physical Properties Laboratory
Southern Utilization Research & Development Division

Discussion — Alfred E. Brown, Moderator
Harris Research Laboratories
Washington, D. C.

6:00 P.M. Social Hour - Mezzanine
(Dutch Treat)

7:00 P.M. Dinner - Green Room
(Tickets available at registration desk)

9:00 A.M., Friday, May 3, 1963

Presiding: Stephen J. Kennedy, Quartermaster Research & Development Center, Natick, Massachusetts

Grafting of Fluoroalkyl Acrylates on Wool
Allen G. Pittman
Wool and Mohair Laboratory
Western Utilization Research & Development Division

Crosslinked Cotton Fabrics Containing Carboxyl Groups
Austin L. Bullock and Charles H. Mack
Cotton Chemical Reactions Laboratory
Southern Utilization Research & Development Division

The Crosslinking of Fabrics Woven of Premercerized Yarns
Alton L. Murphy and Matthew F. Margavio
Cotton Chemical Reactions Laboratory
Southern Utilization Research & Development Division

A Progress Report on Stretch Cotton Fabrics by Slack Mercerization
William G. Sloan
Cotton Finishes Laboratory
Southern Utilization Research & Development Division

Phosphorus-Containing Amides as Versatile Finishes for Cotton
Leon H. Chance
Cotton Finishes Laboratory
Southern Utilization Research & Development Division

12:00 Noon LUNCHEON

1:00 P.M., Friday, May 3, 1963

The Preparation and Stability of Cellulosic Derivatives of N-Methylol Hydrazides
Clifford M. Moran
Cotton Finishes Laboratory
Southern Utilization Research & Development Division

Research Progress on Cotton Batting
N. B. Knoepfler, Homer K. Gardner, Jr., and H. L. E. Vix
Engineering & Development Laboratory
Southern Utilization Research & Development Division

Discussion — Nelson Getchell, Moderator
National Cotton Council
Washington, D. C.

2:30 P.M. Tour and Exhibits of Cotton Research at SU

EFFECT OF STRUCTURE ON THE PROPERTIES OF STRETCH-TYPE COTTON YARNS

by
George F. Ruppenicker and John J. Brown
Cotton Mechanical Laboratory
Southern Utilization Research and Development Division

This is a progress report of research conducted to determine the effect of structure on the stretch and other physical properties of stretch-type cotton yarns produced by the "false-twist" and "back-twist" methods, using thermosetting resins.

In the "false-twist" method, scoured (dyed when applicable) plied yarns were treated with crosslinking resins, dried, cured, and false twisted in one continuous operation. Experimental 24/2 cotton stretch-type yarns were made using single yarn twist multipliers of 3.0 to 4.5, ply yarn twist multipliers of 1.5 to 4.5, and 25 to 50 turns per inch of false twist. Variations in the amount of false twist had more effect on yarn stretch properties than either single or ply yarn twist. Optimum properties for a 24/2 stretch-type cotton yarn were obtained using a single yarn twist multiplier of 4.0 "Z" twist, ply yarn twist multiplier of 4.0 "S" twist and approximately 44 turns per inch of false twist in a "Z" twist direction.

In the "back-twist" method the 24/2 yarns were first plied in the same direction as the single yarns, scoured, (dyed when applicable) treated with resin, dried, cured and then backtwisted on a conventional twister past neutral ply twist. The yarns were scoured (dyed) and resin treated in package form. The drying and curing were performed in dielectric heating equipment. Ply yarn twist multipliers of from 4.0 to 7.0 were used and the yarns were backtwisted using a range of twist multipliers of from 7.0 to 16.0. Optimum properties for a 24/2 stretch-type cotton yarn produced by the "back-twist" method were obtained using a single yarn of "Z" twist and a twist multiplier of 4.5, a ply twist multiplier of 7.0 "Z" twist, and a 15.0 twist multiplier in the "S" twist direction for backtwisting. Generally, these yarns were similar in appearance to those made using false twisting techniques, but produced fabrics having greater amounts of recoverable stretch.

IMPROVING COTTON CLEANING EFFICIENCY WITH THE SRRL FIBER RETRIEVER

by
August L. Miller and Roger S. Brown
Cotton Mechanical Laboratory
Southern Utilization Research and Development Division

Research at the Southern Utilization Research and Development Division to improve the performance of the cotton card has led to the development of a simple means for increasing cleaning at the lickerin while decreasing fiber loss. This device, designated the "Fiber Retriever," replaces the mote knives. With no moving parts, the device utilizes the forces of the lickerin and controlled air currents to remove the foreign matter in cotton.

Two models of the Fiber Retriever are available to meet different mill cleaning requirements. Both models are simple to install and will probably cost no more than a set of mote knives and brackets. The Model M-1 Fiber Retriever consists essentially of two parallel vertical baffles that partially enclose the lickerin between the feed plate and the screen. The unobstructed surface of the lickerin between the baffles affords free movement of air, fiber, and trash so that the heavier trash particles may be more easily separated. Fiber loss is controlled by the upward movement of air between the baffles. The Model M-2 Fiber Retriever is basically two stages of the M-1 Model. It requires a narrow lickerin screen and an intermediate baffle which is equivalent to a two-bar screen.

Laboratory tests indicate that the lickerin removes about 35% more trash with the M-1 Retriever than when using conventional mote knives. Cleaning for the total card is increased 12% and overall fiber loss is reduced 9%. The Model M-2 showed even greater increases in trash removal, with a slight increase in fiber loss.

The trash content of the sliver is reduced about 25%, and short fiber content is also lowered. Yarn tests indicate that a better yarn is produced. Mill evaluations substantiate the improvement in card performance with the Fiber Retriever.

Other advantages include ease of adjustment, negligible maintenance and minimized damage to the card due to lap-end plucking.

IMPROVED TECHNIQUES FOR EVALUATING SPINNING PERFORMANCE OF COTTONS

by
Louis A. Fiori and Gain L. Louis
Cotton Mechanical Laboratory
Southern Utilization Research and Development Division

Steps in the development of an accelerated type spinning test are traced, including the processing variables influencing the variability of end breakage and the statistical treatment of the data to determine the relationship between length spinning time and percent differences in means for significance. It was found that the middle of the bobbin was the most stable for spinning performance tests and that spinning 720 spindle hours on a 240 spindle frame produced results which distinguished performance differences between cottons within reasonable confidence limits.

The initial SRRL 720 spindle hour spinning test maintained constant traveler weight as spindle speed was increased to obtain increased end breakage frequency. As a result, yarn tension varied.

An improved technique was developed whereby yarn tension was maintained constant by properly selecting traveler weight-spindle speed combinations.

This was accomplished indirectly by assuming that bobbin density is proportional to yarn tension. As a result, a series of traveler weight-spindle speed combinations for 30/1 (20 tex) and 40/1 (15 tex) yarns were developed for spinning yarns at different spindle speeds and production rates but at the same yarn tensions.

Proposed is a more valid basis for reporting ends down in spinning based on ends down per one million yards rather than ends down per 1000 spindle hours which is now the common reporting basis. The new basis for reporting ends down will allow more valid comparisons to be made of different cottons or between mills when different spindle speeds and production rates are used.

Illustrative examples are given showing how the improved SRRL 720 Spindle Hour spinning test can be used to determine the effects of twist, draft, spindle speeds, and cotton qualities on end breakage in spinning. Details of the procedure are also described.

EFFECT OF FIBER LENGTH DISTRIBUTION AND SPINNING VARIABLES ON YARN PROPERTIES AND SPINNING PERFORMANCE

by
Gain L. Louis, Louis A. Fiori, Herschel W. Little,
and Lorraine A. Leitz
Cotton Mechanical Laboratory
Southern Utilization Research and Development Division

The spinning efficiency and yarn properties of four sets of cotton of a known variety, but differing widely in fiber length distributions induced through varying harvesting and ginning conditions, were investigated. These cottons were ginned with different combinations of temperature and lint cleaners producing cottons with short fiber contents (3/8 inch and shorter) ranging from 5.52% to 10.15%. The spinning and yarn data obtained from lots of mill-mixes were spun at this Laboratory under similar conditions as those of the experimental cottons, and used as the basis of "mill acceptability" for purposes of comparison. Cotton with end breakage levels similar to those of the mill-mixes were considered as "acceptable".

The improved SRRL 720-Spindle Hour Test Method was used to evaluate spinning performance and end breakage rates were expressed in terms of end breaks per million yards rather than end breaks per 1000 spindle hours. Spinning performance of a cotton was dependent on the fiber length distribution as well as ginning treatment. But within a given ginning treatment, cottons with superior fiber length distributions spun at lower end breakages as compared with cotton with inferior length distribution when spun at similar conditions. However, in the preponderant number of cases, the end breakage rates of the cottons with relatively inferior fiber length distributions were reduced to the mill acceptance level by reducing the spinning drafts or spindle speeds.

The influence of spinning draft on end breakage was more pronounced on cottons with inferior fiber length distributions than on superior cottons. Furthermore, besides corroborating previous findings that cotton with superior fiber length distribution produces stronger and more uniform yarns, as compared with yarns spun from cotton of inferior fiber length distributions, it was found that the latter cotton yielded yarns having a higher degree of fuzziness and produced a yarn bobbin of lower density.

CHANGES IN CERTAIN STRUCTURAL AND MECHANICAL PROPERTIES OF COTTON CELLULOSE WITH HIGH PROGRESSIVE ACETYLATION

by

C. M. Conrad, P. Harbrink, and A. L. Murphy
Plant Fibers Pioneering Research Laboratory
Southern Utilization Research and Development Division

Scoured cotton yarns were acetylated by two processes: (a) by a 1:3 mixture of acetic anhydride and acetic acid to give a series of low- and medium-substituted products (PA); and (b) a 1:1 mixture of acetic anhydride and isopropyl acetate to give a series of medium- to highly-substituted products (FA). Perchloric acid was the catalyst in both processes. The products were studied with reference to rate of esterification and changes in gross morphology, density, x-ray fiber diagram, tensile properties, and thermal behavior at various temperatures up to 230° C.

Esterification proceeds by what appears to be a diffusion-controlled reaction represented by the equation

$$x = kt^m$$

where x is the moles of acetyl added per anhydroglucose residue, t is the time and k and m are constants. However, above about DS = 2, k and m assume new values. At the same time the x-ray diffraction pattern disappears. Although the gross morphology, as viewed by electron microscopy, does not change noticeably during reaction the density decreases progressively with substitution and independent of method of preparation. On the other hand, breaking strength is influenced by acetylation process and increases somewhat as substitution increases.

Thermal studies disclose a plastic region in the products between 125 and 175° C. above which temperature crystallization of cellulose triacetate I sets in and increases progressively with temperature to about 225° C. The plastic and crystal responses of the fibers are reflected in stiffness modulus, elastic recovery and resiliency behavior at different temperature regions. The results are interpreted in terms of molecular structure.

NEW TRIAZONE FINISHES FOR COTTON WASH-WEAR

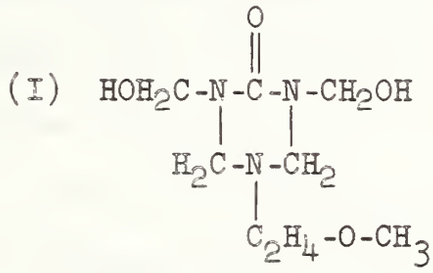
by
Sidney L. Vail
Cotton Finishes Laboratory
Southern Utilization Research and Development Division

The search for new triazones began fairly recently with the issuance of German patent 582,203 in 1933 and its American counterpart, US 2,016,521 in 1935. Since this time many different compounds of this type have been prepared, but apparently only those from urea, formaldehyde, and a primary amine have been accepted as the basis for a wash-wear finish. By varying the primary amine (and, therefore, the 5-substituent in the triazone) different triazones, which in turn produce different finishes, can be prepared. Economy has in many cases limited or eliminated the use of many of these derivatives.

On the other hand, many triazones with different 5-substituents have resisted synthesis. On consideration of the mechanisms suggested for the Mannich reaction this difficulty is not unexpected. However, the reaction is broad enough to allow for some improvements in the triazone-based wash-wear finishes.

In a recent review the main drawbacks listed for the use of methylol-triazones in the wash-wear finishing of cotton fabrics were low efficiency, discoloration at high curing temperatures, and susceptibility to formation of fish-like odors. Hydroxyethyltriazone is relatively free of odor and is used where the afterwash is omitted; however, the hydroxyl group offers a site for competitive reaction, and efficiency (or crosslinking of cellulose) would be expected to decrease.

In this work an attempt has been made to avoid these drawbacks by using new triazones whose 5-substituent is one of various alkoxyalkylene groups. It was reasoned that dimethylol methoxyethyltriazone (I), for example, should produce an improved finish devoid of fish-like odor.



The alkoxyamines are available in commercial quantities. However, the higher cost of these amines, compared to ethanolamine, would be a factor against their use.

POST-IRRADIATION REACTIONS OF COTTON CELLULOSE

by
Florine A. Blouin and Jett C. Arthur, Jr.
Cotton Chemical Reactions Laboratory
Southern Utilization Research and Development Division

Purified cotton cellulose, dried to less than 0.5% moisture, was irradiated in a nitrogen atmosphere with high energy gamma radiation from cobalt-60 at selected dosages up to 6×10^6 roentgens. Post-irradiation chain cleavages of the cellulose molecule on exposure to air were indicated by decreases in the viscosity of the irradiated cellulose with increasing time after irradiation. Post-irradiation reactions of the irradiated cellulose with acrylonitrile were investigated. Low yields of graft-polymer were obtained on treatment of the irradiated cottons with pure acrylonitrile, 5% acrylonitrile in water, and 32% acrylonitrile in N,N-dimethylformamide. The effect of temperature in the 23-100° C. range on these treatments was investigated. High yields of graft-polymer were obtained when the irradiated cottons were treated with acrylonitrile solutions in concentrated aqueous zinc chloride. Some irradiations were carried out in the presence of oxygen and moisture for comparison of these post-irradiation reactions. Results were discussed with relation to the production of long-lived free radicals in the cotton cellulose by high energy gamma radiation. The location of the grafted-polymer in the cotton fiber structure was examined by electron microscopy. Some mechanical properties of polyacrylonitrile-cotton yarns were determined. The most marked changes observed were increases in elongation-at-break and decreases in average stiffness.

EFFECTS OF TENSION IN CROSSLINKING TREATMENTS OF COTTON FABRICS

by
R. S. Orr, J. J. Hebert, L. C. Weiss, and J. N. Grant
Cotton Physical Properties Laboratory
Southern Utilization Research and Development Division

Initially the studies of tension in chemical treatments of cotton were aimed at gaining basic information on the effect of fiber structure on physical properties. Resins change fiber structure on the molecular level. Tension also alters structure by aligning fibrils with the fiber axis. Resin treatment with tension in effect fixes the fibers in the aligned state. Such basic information should help various workers make unerring application for practical utilization. The second purpose in treating with tension was to furnish a guide to possible direct application of tension in resin treatments.

Small fabric samples were treated under tension on a frame. Permanent increases in area from application of tension were as high as 20% on slack-mercerized printcloth treated with a melamine-type resin. Large changes in tensile modulus were achieved by application of tension and by slack mercerization as a pretreatment. Because resin treatment and tension both decrease fabric thickness, the change in modulus did not result in large changes in bending stiffness. Tension increased strip breaking strength but lowered elongation and toughness index. Tension increased tear strength and had no appreciable effect on wrinkle recovery. The effects of tension during treatment with formaldehyde in swollen and semi-swollen condition were achieved by wet stretching and drying the fabric under tension prior to the treatment. Finally a series of fabrics were obtained by the various treatments which exhibited a large variation in crease recovery and other properties. These were used to study the translation of fiber properties into fabric properties. The correlation of fiber strength, elongation, elastic recovery, and modulus with corresponding fabric properties is significant. The correlation of fabric crease recovery with either single fiber or fabric strip elastic recovery at a given strain or a given stress was poor unless samples were separated into groups according to modulus.

GRAFTING OF FLUOROALKYL ACRYLATES ON WOOL

by
Allen G. Pittman
Wool and Mohair Laboratory
Western Utilization Research and Development Division

The numerous properties which can result from the proper application of fluorochemicals on textiles has resulted in a widespread interest in these materials. Some of the desirable properties which can be manifested by textiles treated with fluorochemicals are: (1) oil repellency (e.g., resistance to oil-borne stains), (2) water repellency, (3) protection against various oxidizing media, (4) increased hydrolytic stability, (5) flame resistance, (6) resistance to rot and mildew, and (7) increased flat abrasion resistance.

The present discussion deals primarily with an investigation of the properties of wool fabric treated with reactive copolymers prepared from 1,1-dihydroperfluorooctyl acrylate and methacryloyl chloride. Other reactive fluoroalkyl acrylate copolymers, i.e., copolymers containing pendant glycidyl ether groups will also be mentioned.

One of the most vexing problems in the use of any resin as a textile finishing agent is the attainment of finish-durability. Durability of thermoplastic resins applied to textiles can be achieved either by attachment of the resin to the fabric through covalent bond linkages (grafting) or by converting the thermoplastic resin to a thermoset (crosslinking). Durability was obtained by polymer-wool graft formation with the copolymers employed in this study. Grafting occurred primarily through reactions involving the pendant acid chloride groups of the copolymer with hydroxy and amino groups present in keratin fibers.

The resins provided oil and water repellency, resistance to felting shrinkage and resistance to acid, alkali and oxidizing media. The hand and flexural rigidity of the fabric were altered slightly, whereas wrinkle recovery, fabric break, tear strength and abrasion resistance were not significantly changed.

Aside from rendering the polymer insoluble to drycleaning solvents, grafting permitted the use of smaller amounts of resin for shrinkage protection than was required with nongrafted polymer. The wash fastness of the oleophobic-hydrophobic finish was essentially the same in a comparison of a grafted copolymer fluoroalkyl acrylate and a nongrafted homopolymer fluoroalkyl acrylate.

CROSSLINKED COTTON FABRICS CONTAINING CARBOXYL GROUPS

by
Austin L. Bullock and Charles H. Mack
Cotton Chemical Reactions Laboratory
Southern Utilization Research and Development Division

Samples containing both crosslinks and carboxyl groups were prepared by the three following procedures: (1) carboxymethylated and then crosslinked (CM-XL); (2) crosslinked and then carboxymethylated (XL-CM); and (3) crosslinked with simultaneous introduction of carboxyl groups (XL°COOH). Comparison of the wet crease recoveries, the dry crease recoveries, and the water of imbibition has shown considerable differences caused by the method of treatment. The differences are most noticeable in values for water of imbibition, when both groups are introduced simultaneously. These values fall between those of samples prepared by the other two methods. In general, this is also true of crease recovery values if the samples have approximately the same carboxyl content. Samples crosslinked first (XL-CM) have higher values for water of imbibition, higher wet crease recoveries, and greater changes in dry crease recovery with increasing extent of crosslinking. The reason for these differences is believed to be related to the ability of the sample to swell when wet.

THE CROSSLINKING OF FABRICS WOVEN OF PREMERCERIZED YARNS

by
Alton L. Murphy and Matthew F. Margavio
Cotton Chemical Reactions Laboratory
Southern Utilization Research and Development Division

The losses ordinarily encountered in the crosslinking of cotton yarn and fabric have been overcome by slack mercerization and restretching the cotton in yarn form, and crosslinking fabric woven of these yarns.

Two-ply grey and scoured yarns were mercerized by different methods and under different conditions.

1. Mercerization at normal length.

   Two different concentrations and two different temperatures were used, 11% NaOH at 0° C. and 22% NaOH at 25° C.

2. Mercerization slack and restretched to normal length, using 11% NaOH at 0° C. and 22% NaOH at 25° C.

3. Mercerization with full shrinkage with 22% NaOH at 25° C.

It was found that yarns mercerized at normal length and with full shrinkage, using both 11 and 22% NaOH, gave mostly losses in strength after crosslinking with DMEU when compared to the grey and scoured controls. Yarns mercerized slack and restretched showed large gains in strength after crosslinking.

Two fabrics used in this work were similar in both yarn and fabric construction, a 44x48 sheeting. One fabric was woven from 40/2 grey yarn and the other fabric from 40/2 yarn that had been mercerized slack and restretched to 91% of its original length. Though these fabrics were of the same construction, there were differences between them in breaking and tearing strength, both before and after crosslinking with DMEU, the greater difference found after crosslinking. Both the breaking and tearing strength of the mercerized fabric after crosslinking were greater than the grey untreated fabric.

Broadcloth (90x42) made from 40/2 kierboiled and 40/2 mercerized yarn, the warp and fill the same yarn, lost considerable in breaking strength after crosslinking with DMEU. The kierboiled fabric lost in tearing strength, while the mercerized fabric seemed to have an increase in tearing strength.

A PROGRESS REPORT ON STRETCH COTTON FABRICS BY SLACK MERCERIZATION

by
William G. Sloan
Cotton Finishes Laboratory
Southern Utilization Research and Development Division

Methods of producing all-cotton stretch fabrics by slack mercerization, their physical properties, test methods used, and the effect of fabric construction is briefly summarized. The type of fabrics being produced commercially is discussed as well as how much stretch and recovery is required in various end uses.

Studies are being made on yarns to determine the correlation that exists between shrinkage, shrinking form, and swelling. Methods of measuring these properties are described. Tests were made in 9%, 18%, 23%, and 32% solutions of sodium hydroxide and potassium hydroxide at room temperature. Results obtained are given and the correlation existing between the tests is discussed.

Exploratory work to produce all-cotton stretch hose from slack mercerized yarn is described. Hose knit from a 2-ply slack mercerized yarn after dyeing met all of the specifications for a stretch hose. Data on yarn construction, and yarn shrinkage after mercerization, rewinding, and relaxing in boiling water is given.

A roll of slack mercerized broken twill fabric, having stretch in the filling direction, was coated commercially with a polyvinyl chloride coating. Properties of this fabric were compared with those of unmercerized broken twill fabrics which had vinyl coatings. The coated stretch fabric, although lighter in weight, was stronger than the other coated fabrics and had better stretch properties.

Various techniques for molding slack mercerized stretch fabrics are discussed. Fabrics having sufficient elongation characteristics can be molded by simply restretching the fabric during molding. The equipment used consists of a male mold and a clamp that matches the outer periphery of the mold. Advantages of molded fabrics and potential end uses are discussed. Slides are shown illustrating the equipment and molded products.

PHOSPHORUS-CONTAINING AMIDES AS VERSATILE FINISHES FOR COTTON

by
Leon H. Chance
Cotton Finishes Laboratory
Southern Utilization Research and Development Division

In 1962 a new durable wash-wear finish for cotton which is resistant to chlorine damage was reported by the Southern Utilization Research and Development Division. This finish was based on the methylol derivative of tris(2-carbamoyl-ethyl) amine (TCEA). TCEA is prepared from acrylamide and ammonia.

In a current investigation to produce flame resistance and wrinkle resistance in a single finish, two compounds were synthesized -- (1) tris(2-carbamoylethyl)phosphine (TCEP), the phosphorus analog of TCEA, and (2) tris(2-carbamoylethyl)phosphine oxide (TCPO), the oxidation product of TCEP. Since attempts to prepare TCEP from phosphine and acrylamide were unsuccessful, it was prepared by the reaction of ammonia with the ethyl or methyl ester of tris(2-carboxyethyl)phosphine. TCPO was prepared by the reaction of acrylamide, yellow phosphorus, and potassium hydroxide.

The methylol derivatives of TCEP and TCPO were prepared by reaction with formaldehyde in aqueous alkaline solution. The methylol derivatives were applied to cotton fabric by conventional pad, dry, and cure techniques in the presence of magnesium chloride or zinc nitrate to impart both wrinkle resistance and flame resistance. However, at the add-on required for good wrinkle recovery - 5-10% - the flame resistance is only moderate. Breaking strength and tearing strength losses are comparable with those of the conventional methylol amides.

TCEP, unlike many tri-substituted phosphines, does not oxidize to the phosphine oxide even when heated in air. The TCEP apparently retains its basic characteristic after its application to cotton fabric, since it lessens the susceptibility of the cotton to chlorine damage. For example, strength retention of about 80% was obtained on TCEP treated cotton after chlorine bleaching and scorching, whereas only 10-20% strength retention was obtained on TCPO treated cotton.

THE PREPARATION AND STABILITY OF CELLULOSIC DERIVATIVES OF N-METHYLOL HYDRAZIDES

by
Clifford M. Moran
Cotton Finishes Laboratory
Southern Utilization Research and Development Division

The formation of cellulosic derivatives of hydrazide-formaldehyde adducts has been extensively studied. These adducts have been used as wrinkle resistance finishing agents for cotton fabric. One of the advantages which has been reported for these finishing agents is that they exhibit negligible chlorine retention upon bleaching with hypochlorite solution and, as a result, there is only minor fiber degradation due to such chlorine retention compared to that in fabrics finished with other nitrogen-containing agents. Another advantage previously claimed for these hydrazide-formaldehyde finishing agents is their resistance to acidic or basic hydrolysis.

This study describes the preparation of hydrazide-formaldehyde finishing agents, their application to cotton cellulose, physical properties of the resultant fabrics, and the testing of the stability of these cellulose derivatives to hypochlorite oxidation and hydrolysis. Eight hydrazides were used to prepare cellulose derivatives: succinic dihydrazide, diglycolic acid dihydrazide, diformylhydrazine, diacetylhydrazine, ethylhydrazodicarboxylate, monoacetylhydrazine, 1-acetyl-2,2-dimethylhydrazine, and trihydrazino-s-triazine.

The stability of the cellulose derivatives was tested in several ways. The amount of nitrogen retained on the fabric was taken as a measure of the stability of the finish.

In general, treatment of the finished fabrics with aqueous hypochlorite solution removes much of the nitrogen. Absence of unsubstituted sites on the finishing agent appears to be important for stability toward hypochlorite oxidation. Acidic and basic hydrolyses also remove nitrogen from some of the finishes. The fabrics finished with symmetrically substituted hydrazides exhibit under greater retention of nitrogen after hydrolysis than do those finished with unsymmetrically substituted compounds.

RESEARCH PROGRESS ON COTTON BATTING

by
N. B. Knoepfler, Homer K. Gardner, Jr., and H. L. E. Vix
Engineering and Development Laboratory
Southern Utilization Research and Development Division

Research to improve cotton batting is a cooperative project jointly sponsored by The Textile Waste Association, The National Cottonseed Products Association, The National Cotton Batting Institute, The Foundation for Cotton Research and Education, and the Southern Utilization Research and Development Division. A moving picture will be shown demonstrating the following information.

Research was undertaken in July 1961 directed at finding a means of improving the performance of cotton batting to enable it to better compete with synthetic foams in cushioning markets. Four areas of approach were envisioned in the project; (1) chemical or mechanical means of enhancing the performance characteristics of cotton batting including the use of resins and/or other chemical treatments to improve the resilience of the individual fibers and/or the bulk of the fibers, (2) adhesives to accomplish an improvement in the dimensional stability, coherence and resistance to compaction upon prolonged use, (3) means of crimping, kinking, curling, interlocking either mechanically or chemically, and (4) achievement of fiber orientation other than parallel layers.

The initial phase of the research was to determine a practical method of applying the treatment. Dry powders were considered, as were spraying using solutions/suspensions, and wet immersion processing. The first mentioned method of application was held in abeyance because most resins of this class do not chemically react with the cotton, and the last mentioned seemed too expensive to be economically feasible. Spray systems are versatile, low cost and reasonably easily maintained.

The next phase of this research consisted of the screening of a number of types and classes of resins for their contribution to the properties of the finished product. Both thermosetting and thermoplastic resins were evaluated with particular emphasis on those resins known to be capable of reacting with the cellulose of the cotton. Resins screened include methylated methylol melamine, urea formaldehyde, acrylic, trimethylol melamine, polyethylene, acid colloids of melamine formaldehyde and methylated methylol melamine, dimethylene ethyl carbamate and others. Microscopic examination using cupriethylenediamine as a swelling agent indicated that some crosslinking had been achieved with some of these compounds. Several tests on physical properties indicated that some improvement had been made in the resilience of the individual fibers.

To achieve dimensional stability and coherence in the batts a series of chemical compounds classified as resinous latexes were evaluated. These

include vinyl acetate copolymer, vinyl acetate homopolymer, styrene butadiene copolymer, vinyl acrylic copolymer, polyvinyl acetate homopolymer, vinyl chloride acrylic copolymers, styrene butadiene acrilonitrile copolymers and others. For simplicity of plant operation formulations were devised so that all of the components were mutually compatible and the treatment could be applied from a single spray nozzle feed tank. Pot life of the systems were also considered. Where thermoplastic resins were used drying temperatures in excess of 160-170° F. were usually sufficient to cure the resins and latexes. In general these systems were not as good as the thermosetting resins in improving product performance. Where thermosetting resins are used it is necessary that temperatures of 300° F. be attained for 2 to 3 minutes throughout the batt to set the resin. It has been found that products having much improved resistance to set as a result of compressional loading can be produced using these thermosetting resins. By incorporating a small percentage of the solids as butadiene styrene, the performance of resin-latex treated batts under conditions of 100% relative humidity can be significantly improved.

Because the products of the cotton batting industry today are sold on the basis of subjective evaluation, it has been necessary as this research developed to devise objective evaluations which would demonstrate differences in the performance of the products. One such test is the cyclic loading of a sample of batting at the rate of 1 lb. per sq. in. under conditions of 60% and 100% relative humidity. Data can be obtained during this test which gives the compressability of the sample, its set after 50 repeated loadings, and its recovery over a period of time. Current research emphasis is to determine what fiber orientation contributes to the performance of the product. Efforts are being made to achieve randomization of fibers, or some type of orientation significantly different to the type of fiber array ordinarily achieved by garnetting. Manufacturers of batting have shown much interest in the new process, and several have experimentally produced the product in their plants. Samples of products using the newly developed techniques and formulations have been submitted to all of the major automobile manufacturers.

At the conclusion of the movie a brief report will be made giving the results to date of commercial evaluations being made on cotton batting.

BIOGRAPHICAL SKETCH

Florine A. Blouin

Miss Blouin is a native of New Orleans. She received a B.S. degree in chemistry in 1953 and an M.S. degree in biochemistry in 1956 from Louisiana State University.

For the past 10 years Miss Blouin has been employed at the Southern Utilization Research and Development Division. For about three years she conducted fundamental research on the structure and chemical reactions of cotton cellulose, glycosides, oligosaccharides and glucose, and was coauthor of six publications in these fields. During a part of this time she held the Starch Industries Fellowship.

At present, she is a research chemist in the Radiochemistry Investigations of the Cotton Chemical Reactions Laboratory. Her work with this group has included investigations of the mechanism of interaction of ionizing radiation with cotton cellulose and the radiation-induced reactions of cotton cellulose. She has been the coauthor of seven publications in this field.

Miss Blouin is a member of the American Chemical Society and the Scientific Research Society of America.

BIOGRAPHICAL SKETCH

Alfred E. Brown

Dr. Alfred E. Brown was born in Elizabeth, New Jersey. He received a B.S. in chemistry from Rutgers in 1938, and a Ph.D. from Ohio State in 1942. He was at the Eastern Utilization Research and Development Division, USDA, working on regenerated protein fibers, and then at the Office of Scientific Research and Development, prior to joining Harris Research Laboratories in 1945, where he is now President and Director of Research.

Dr. Brown's research was concerned mainly with carbohydrate and protein chemistry, especially as related to textile and fibrous materials. His major accomplishments have been in the field of keratin chemistry, specifically on wool and human hair, and its practical applications to textile and cosmetic problems. He is the author of approximately 20 publications and 13 patents.

Dr. Brown is active in a number of professional associations. He is a member of the AAAS, ACS, AATCC, AIC, the Society of Cosmetic Chemists, the Textile Research Institute, the Textile Institute of England, the Fiber Society, the Washington Academy of Sciences, the New York Academy of Sciences, and the Cosmos Club. He is a member of the honorary societies of Phi Beta Kappa, the Society of Sigma Xi, and Phi Lambda Upsilon.

Dr. Brown is presently Vice President of the Science Manpower Commission, and President of the Chemical Society of Washington, the local section of the American Chemical Society.

BIOGRAPHICAL SKETCH

Austin L. Bullock

Mr. Bullock was born in Walthal County, Mississippi. He finished high school and attended Copiah-Lincoln Junior College at Wesson, Mississippi for a period of two years.

He is a graduate of Thermo Air Conditioning Institute, Los Angeles, California. For several years prior to World War II he worked as an electrical contractor in Tylertown, Mississippi. During World War II he served in Australia, New Guinea and the Philippine Islands as a member of the U. S. Army Signal Corps.

After the war he returned to school at Mississippi College, Clinton, Mississippi, obtaining a B.S. degree in Chemistry. He taught in the public high schools of Mississippi for 5-1/2 years prior to his employment at the Southern Utilization Research and Development Division in January 1953.

In his present assignment he is a project leader in Exploratory Investigations, Cotton Chemical Reactions Laboratory.

Leon H. Chance

Mr. Chance is a native of Georgia. He obtained B.S. and M.S. degrees in chemistry from the University of Georgia, with a major in organic chemistry.

For three years he was employed at the Eastman Kodak Company in Rochester, New York in organic synthesis. For two years he worked in process development at the Chemstrand Corporation in Decatur, Alabama.

He has been employed at the Southern Utilization Research and Development Division for the past eleven years, his work concerned with the chemical processing of cotton, mainly in the areas of wash-wear, water repellency, and flame resistance.

Mr. Chance is a member of the American Association of Textile Chemists and Colorists, the American Chemical Society and the New Orleans Academy of Sciences. He has authored over 30 technical papers and patents on the chemical processing of cotton.

BIOGRAPHICAL SKETCH

Sydney M. Cone, Jr.

Mr. Cone was born and educated in Maryland, receiving a B.A. degree from John Hopkins University in 1925. He is at present vice president in charge of research at the Cone Mills Corporation, Greensboro, North Carolina.

He is a member of the Executive Committee of the Textile Research Institute, a member of the Technical Advisory Committee of the Southern Garment Manufacturers Association, and has served with distinction in these and other research organizations. He contributed to the war effort as an Industry Member of the War Labor Board in 1944.

Mr. Cone has gained a national reputation as a leader in the textile industry. He served as General Chairman of our Cotton Conference in 1962, and this year has accorded us distinction by serving as our Honorary Chairman.

Carl M. Conrad

Dr. Conrad was born in Kansas. He received his B.S. degree in Agricultural Chemistry from Kansas State College in 1921. In 1923 he was awarded an M.S. and in 1925 his Ph.D. degree from the University of Maryland.

He held teaching fellowships at the University of Maryland during 1923-31, then joined the Agricultural Marketing Service where he served as project leader for cotton quality until 1941.

Since July 1941 he has been associated with the Southern Utilization Research and Development Division serving in various capacities. From 1952 to 1957 he served as Head of the Cotton Fiber Section, and in January 1958 was named leader of the Plant Fibers Pioneering Research Laboratory.

He is a member of a number of scholastic and professional organizations, including American Association for Advancement of Science, The American Institute of Chemists (Fellow), and Alpha Chi Sigma Chemical Fraternity. A member of the American Chemical Society since 1922, he has held positions of Councilor and Member of the Executive Committee of the Division of Cellulose Chemistry, and was Chairman of the latter during 1956-57. He was Chairman of the Louisiana Section during 1959. He was a member of the American delegation to the International Standardization Organization at Buxton, England, in 1948 and during the fall of 1958, he visited various textile and cellulose research institutes in England and Northern Europe.

BIOGRAPHICAL SKETCH

Frederick B. Dent

Mr. Dent was born at Cape May, New Jersey, and grew up in Greenwich, Connecticut. Following graduation from Yale University with a B.A. degree, he went on active duty in the United States Naval Reserves during World War II with service in the Pacific Theater of operations.

Upon release from active duty he joined the firm of Selling Agents for Textile Mills in New York, Joshua L. Baily & Co., Inc.

In 1947 he moved to Spartanburg, South Carolina, to join the staff of Mayfair Mills and today serves as President and Treasurer of this organization which has two plants in Arcadia, South Carolina, and one in Easley, South Carolina.

Mr. Dent presently serves as a Trustee of the J. E. Sirrine Textile Foundation which is dedicated to the continuing improvement of the School of Industrial Management and Textile Science at Clemson College, The Institute of Textile Technology in Charlottesville, Virginia, and is a Director of the American Textile Manufacturers Institute.

Louis A. Fiori

Mr. Fiori is Head of the Processing Efficiency Investigation of the Cotton Mechanical Laboratory of the Southern Utilization Research and Development Division. He graduated in 1942 from Georgia Institute of Technology, majoring in Textile Engineering.

As a Cotton Technologist, Mr. Fiori has had 20 years of research experience in establishing fiber-to-yarn-to-fabric proper inter-relationships and processing procedures for maximum utilization of fiber properties. Prior to attending college, he had four years of practical experience in the woolen and worsted industry.

He is the author of numerous publications; and in 1956 and 1960 he represented the U. S. Department of Agriculture as a Delegate to the Plenary Conference of the International Organization for Standardization (ISO), Technical Committee 38 on Textiles, which were held in England.

He is a member (Fellow) of The Textile Institute, The Fiber Society, The American Society for Testing and Materials, Committee D-13 on Textiles (serves as Secretary of Subcommittee A-1 on Cotton Fibers), Scientific Research Society of America, Textile Quality Control Association, and Phi Psi.

BIOGRAPHICAL SKETCH

Nelson F. Getchell

Nelson Getchell is a native of Lowell, Massachusetts, and a graduate in Textile Chemistry of the Lowell Technological Institute. Following graduation, he was employed for two years in the Dye Application Laboratory of the Ciba Company in New York City. From 1940 to 1943 he was Chief Chemist and Dyer for Goodall Worsted Company (Palm Beach Mills) in Sanford, Maine.

In 1943 he joined the research staff of the Ludlow Manufacturing and Sales Co. as group leader in fiber processing research. In 1946 he became Assistant Manager of the Fiber and Foreign Department of that company in Boston, Massachusetts.

Since 1951 he has been on the technical staff of the Utilization Research Division of the National Cotton Council in Washington, D. C.

BIOGRAPHICAL SKETCH

Otto Goedecke

Mr. Otto Goedecke was born in Bremen, Germany, the important cotton port for the Continent, and came to this country in 1926 under the sponsorship of the Cotton Cooperatives Organization and spent his first five years gathering practical experiences with this organization in North Carolina and with the Oklahoma Cotton Growers Association in their sales office located at Houston, Texas. While in North Carolina, Mr. Goedecke attended North Carolina State College studying cotton classing and spinning evaluation. In Houston, Texas, he attended the Houston Law School at night classes, completing his work with a Bachelor of Law Degree. He was admitted to the Texas State Bar in 1933.

Mr. Goedecke is the founder and President of the firm of Otto Goedecke, Inc., which started as a proprietorship in 1932, and was incorporated under the Laws of Texas in 1946. This firm inaugurated Modern Merchandising of cotton by scientific means and established its own fiber laboratory in 1946 and has been pioneering in this work ever since. Mr. Goedecke is president of a number of affiliated companies related to the cotton business and connected with the management of three cotton mills in Texas.

Mr. Goedecke is a member of the New York and New Orleans Cotton Exchanges; the Houston Cotton Exchange and Board of Trade, as well as Associate Member of the Liverpool Cotton Association and the Bremen Cotton Exchange; and also member of the American Cotton Shippers Association; a member of the Textile Research Institute, the American Management Association, and the Texas Academy of Science. At the present time Mr. Goedecke is serving as a member of the U.S.D.A. Cotton and Cottonseed Research and Marketing Advisory Committee; a member of the National Advisory Committee of the New York Cotton Exchange; Advisor to the President of the National Cotton Council of America.

Mr. Goedecke is a Rotarian and is a past president of the Hallettsville Rotary Club; and he is presently Chairman of the Hallettsville Service Unit of the Salvation Army and a member of the Development Board of Texas Lutheran College at Seguin, Texas. In June 1962 he received an Honorary Law Degree (L.L.D.) from the Texas Lutheran College, Seguin, Texas.

BIOGRAPHICAL SKETCH

Stephen J. Kennedy

Dr. Kennedy was born in Shanghai, China. He received a B.A. degree from the University of Illinois in 1926, an M.A. degree from Columbia University in 1931, and a Ph.D. from the same institution in 1936.

Prior to World War II he served as Director of Market Research, Pacific Mills, New York City. In 1941-42 served on the staff of the Textile Bureau, War Production Board. During World War II he served as Lt. Colonel in the Quartermaster Corps and was assigned as Chief of the Textile Section, Research and Development Branch, Office of the Quartermaster General. He organized and sent to Germany in 1945 the Technical Intelligence Investigating teams sent out by the Technical Industrial Intelligence Committee of the Joint Chiefs of Staff for the organizing of research developments in textiles during and preceding the War. As a result of this he was decorated with the Army Commendation Medal and the Legion of Merit.

At present he is Research Director of the Textile, Clothing and Footwear Division of the Quartermaster Research and Engineering Command at Natick, Massachusetts.

He is a member of the Textile Institute (England), American Association of Textile Chemists and Colorists, American Leather Chemists Association, Textile Research Institute, American Chemical Society, and Phi Beta Kappa. He is author of Profits and Losses in Textiles, 1936; and Textile Markets (with Hiram S. Davis and Others), 1938; and has contributed many articles in scientific and technical publications.

BIOGRAPHICAL SKETCH

Nestor B. Knoepfler

Mr. Knoepfler was awarded a B.E. degree in Chemical Engineering from Tulane University in 1940, following which he was employed as a Laboratory Assistant at the Southern Cotton Oil Company, Gretna, La.

From 1941 to 1946 he served in the U. S. Navy, returning to inactive duty with the rank of Lt. Commander, USNR.

For four years he was employed as Assistant Manager, Processing and Equipment Development, Southern Photo Craft. He was a National Cottonseed Products Association Fellow at the Southern Utilization Research and Development Division from 1950 to 1952 conducting research on oilseed processing.

He joined the staff of the Southern Utilization Research and Development Division in 1952 as a Junior Chemical Engineer conducting research on oilseed processing and process development. From 1955 to 1960 he served as an Assistant to the Director of the Southern Division with duties in Program Appraisal, Program Development and PL-480 Foreign Research Program. Since 1960 Mr. Knoepfler has served as a Project Leader carrying out chemical engineering research on cotton and cotton linters in the Engineering and Development Laboratory.

He is a member of the American Oil Chemists' Society, The New Orleans Academy of Sciences, The Scientific Research Society of America, Sigma Phi Epsilon, Society of Tulane Engineers, U. S. Naval Reserve; and is the author of approximately 33 technical articles and has made numerous presentations at scientific and professional meetings.

BIOGRAPHICAL SKETCH

Gain L. Louis

Mr. Louis was educated in elementary and secondary schools in Shanghai, China and received the Bachelor of Science Degree in Textile Engineering in 1951 from Texas Technological College. He joined the Texas Textile Research Laboratories at Texas Technological College and engaged in a research program on cotton problems; meanwhile, he did graduate work in mathematics in that college.

He joined the U. S. Department of Agriculture's Southern Utilization Research and Development Division as a research Textile Technologist in July 1956. In the Division's Cotton Mechanical Laboratory, Mr. Louis has conducted research aimed at establishing conditions needed for the optimum utilization of the properties of the cotton fiber in appropriate yarn and fabric constructions, and has authored numerous technical papers disclosing the results of these investigations. He is a registered professional textile engineer in Texas, a member of ASTM Committee D-13 and Phi Psi, and an associate member of the Scientific Research Society of America.

August L. Miller

Mr. Miller, a native of New Orleans, Louisiana, received the B.E. degree in mechanical engineering from Tulane University in 1939.

As project engineer and area engineer with the Corps of Engineers, Department of the Army, for 13 years, he was engaged in design and production of marine equipment and mechanical structures for flood control projects.

For the past eight years Mr. Miller has been with the Southern Utilization Research and Development Division as project leader conducting basic and applied research directed toward improving the cotton carding machine.

BIOGRAPHICAL SKETCH

Clifford M. Moran

Mr. Moran was born in Duluth, Minnesota.

He received his B.S. degree in 1952 from the Duluth Branch of the University of Minnesota, and his M.S. in 1959 from the same university.

For two years he was employed by the Aerojet-General Corporation in Ayusa, California.

Since then Mr. Moran has worked as an organic chemist in the Wash-Wear Investigations of the Cotton Finishes Laboratory of the Southern Utilization Research and Development Division. His project has been concerned with finding N-methylol finishes for high quality, durable, wash-wear cotton fabrics.

He is a member of the American Chemical Society, American Association of Textile Chemists and Colorists, Scientific Research Society of America, and the American Association for the Advancement of Science.

Alton L. Murphy

Mr. Murphy was born in Brewton, Alabama, and attended public school there. He has an A.B. degree in chemistry from Howard College, Birmingham, Alabama.

In 1942 he joined the staff at the Southern Utilization Research and Development Division. He was a member of a group which received the USDA Superior Service Award for developing partially acetylated cotton. At present, he is project leader, Exploratory Investigations, Cotton Chemical Reactions Laboratory.

He is a member of the American Chemical Society and the Scientific Research Society of America.

BIOGRAPHICAL SKETCH

Rollin S. Orr

Mr. Orr is a native of Texas, and received a B.S. degree in Physics, 1938, and an M.S. degree in Physics, 1941, from Texas Technological College.

Since 1941, he has been employed at the Southern Utilization Research and Development Division of the U. S. Department of Agriculture in research on the physical properties of cotton. He is a member of the Fiber Physics Investigations of the Cotton Physical Properties Laboratory, where his principal interests are in instrumental methods of measuring fiber properties, the interrelations of the fiber properties, and the effects of mechanical and chemical processing on the fiber properties. Mr. Orr is the author or coauthor of 25 papers dealing with advances in this area.

He was awarded the U. S. Department of Agriculture Superior Service Award for outstanding achievements through the ingenious development and application of methods, instruments, and analyses of cotton fiber structures responsible for their physical behaviors during testing, chemical treatments, and in fabrics for civilian and industrial uses.

William M. Pittendreigh

Mr. Pittendreigh is Director, Textile Manufacturing Development, Reigel Textile Corporation, Southern Executive Offices, Ware Shoals, South Carolina. Previous to this appointment he served as Superintendent of the Ware Shoals mills.

He has been prominent in the Southern Textile Association, an association of operating executives, for a good many years and is a past president of this association.

Mr. Pittendreigh is widely recognized as a leader in technical research as evidenced by his participation in technical meetings. At the National Cotton Council Research Clinic-Marketing Conference in 1961 he served as a session chairman. Again, at a recent conference of this same group he presented a paper on the evaluation of the Rando-Cleaner.

BIOGRAPHICAL SKETCH

Allen G. Pittman

Dr. Allen G. Pittman is a native of Texas. After obtaining a B.S. in chemistry from the University of Texas in 1954, he spent two years as a Lt. (j.g.) in the U. S. Navy aboard the aircraft carrier U.S.S. Kearsarge. In 1956 he returned to the University of Texas for graduate study and received a Ph.D. in Organic Chemistry in 1960.

Following this, two years were spent in the Pioneering Research Division of the Plastics Department of the DuPont Company in Wilmington, Delaware. He joined the staff of the Western Utilization Research and Development Division in August of 1962. His research interests include fluorocarbon chemistry, silicone chemistry, synthesis and characterization of polymers, organic reaction mechanisms and the chemistry of wool.

George F. Ruppenicker

Mr. Ruppenicker is a native of Long Island, New York. He received his B.S. degree in Textile Engineering from the Georgia Institute of Technology in 1954 and for the past eight years has served as a research textile technologist in the Cotton Mechanical Laboratory, Southern Utilization Research and Development Division.

His researches have included investigations of the processing characteristics of long staple American Egyptian Cottons and high strength interspecies Upland type cotton. More recently he has conducted research to develop winter weight cotton fabrics and stretch-type cotton yarns and fabrics. Mr. Ruppenicker is the author of a number of publications and is a member of the ASTM Committee D-13.

BIOGRAPHICAL SKETCH

Robert F. Schwenker, Jr.

Mr. Schwenker was born in Michigan and reared in southern Indiana.

He obtained a B.A. degree in Chemistry in 1948 from the University of Pennsylvania. From 1948-1950 additional graduate study in physical and organic chemistry was done at Rutgers University.

For five years he was on active duty in the U. S. Army on overseas duty in the European Theatre. He is presently in the Army Active Reserve component with the rank of Lt. Colonel, Artillery.

In 1951 he joined the Textile Research Institute as a chemist. From 1955 to 1960 he was a group leader and at present is Associate Research Director, conducting research in (1) chemical reactivity and modification of cellulose, and (2) high-temperature characteristics and behavior of textile materials.

He is a member of the American Chemical Society, Fiber Society, Technical Association of the Pulp and Paper Industry, Textile Institute (British), and Sigma Xi.

William G. Sloan

Mr. Sloan received a B.S. degree in Textile Chemistry & Dyeing from North Carolina State College and has also taken advanced chemistry courses at Tulane University.

He has a total of 28 years' experience in the field of textile chemistry and in cotton chemical finishing research. Since joining the staff at the Southern Utilization Research and Development Division in 1948 as project leader, he has conducted a progressive research program on the development of cotton textiles resistant to water penetration and having improved heat, rot, and weather resistance through chemical modification and other treatments.

In 1956 he was a member of the Cotton Acetylation Research Group which received the Superior Service Award from the Department of Agriculture. At present, he is project leader of research to produce cotton stretch fabrics by slack mercerization.

He is a member of the American Association of Textile Chemists and Colorists, the American Chemical Society, and the Scientific Research Society of America, and is author or co-author of more than 20 technical papers and patents.

BIOGRAPHICAL SKETCH

Sidney L. Vail

Mr. Vail received a B.S. degree in chemistry from Tulane University in 1949. His M.S. degree in organic chemistry was obtained in 1951 from Louisiana State University. Additional graduate work was done at the University of Maryland and at Tulane University.

Prior to graduation in 1951, and until entering the service, Mr. Vail was employed by the Dow Chemical Company in Freeport, Texas, as an organic chemist in their basic organic laboratory.

During the period 1953 to 1955 he was in the U. S. Army, stationed at Edgewood Arsenal, engaged in the synthesis of new agents for chemical warfare.

After separation from the Army he joined American Cyanamid in New Orleans as a senior chemist and worked largely with studies related to the stability and reactions of HCN, methylstyrene, and acetylene. Early in 1959 he joined the Southern Utilization Research and Development Division. He is a project leader concerned with the synthesis and application of new or unusual compounds to cotton to produce wash-wear properties. In addition, since 1959 he has instructed at Tulane University on a part-time basis.

SUPPLEMENT TO ABSTRACTS

THIRD COTTON UTILIZATION RESEARCH CONFERENCE

May 2-3, 1963

Southern Utilization Research and Development Division
Agricultural Research Service
United States Department of Agriculture
New Orleans 19, Louisiana

Discussion following presentation of: "Effect of Structure on the Properties of Stretch-Type Cotton Yarns" by George F. Ruppenicker.

Question: What is the comparison in cost per pound of yarn of false twisted and back twisted yarns?

Mr. Ruppenicker: It is estimated that the total cost for either method would be in the range of from $1 to $1.50 per pound for 24/2 yarn. This can be broken down as follows: Bleached cotton yarns (carded) - 70¢ to 75¢ per pound; resin treatment - about 10¢ per pound; twisting and various other costs - 20¢ to 65¢ per pound.

Question: Has any determination been made of the relative uniformity or efficiency of cure of packaged, back-twisted yarns cured by dielectric heating techniques?

Mr. Ruppenicker: The treatment was uniform throughout the package with the exception of the first few hundred yarns which had a higher resin add-on due to surface evaporation. This can probably be corrected by using an outer covering of knit cotton tubing.

The crosslinking efficiency was good. About 70% of the finishing agent applied (DMEU) reacted with the cotton.

Question: Does the use of yarns with false twist cause any problems in knitting or weaving?

Mr. Ruppenicker: Stretch-type cotton yarns with a normal 2-ply construction offer no problems in weaving. However, those with an unbalanced twist-on-twist final construction are unruly and require additional shuttle tension.

Preliminary trials for knitting stretch-type cotton yarns indicate that softeners and/or lubricants are required. Additional work on knitting techniques is planned.

Question: In the production of stretch yarns using false-twist equipment:

(a) Has any work been done using 30's and 40's yarn, and if so, are the results comparable to those obtained with 24's?

(b) Was greige yarn or boiled-off yarn used?

(c) Were your singles yarns separated at the iron-head? If yes, did yarn-to-yarn resin polymerization (yarns sticking together) cause excessive ends down?

Mr. Ruppenicker: (a) Stretch-type cotton yarns have been produced by the false-twist method over a range of yarn sizes of from 20/2 to 30/2 with comparable results. There is no reason to believe that yarn size would be a limiting factor except that the production rate would possibly have to be reduced for extremely coarse yarns to allow additional time for drying and curing. Satisfactory stretch-type yarns have been made over a range of yarn sizes of from 4/2 to 60/2 using the back-twist method. Approximately the same twist multipliers were used for all sizes.

(b) The yarns were scoured and bleached or dyed before resin treating, curing, and false-twisting.

(c) No yarn separation was done. All the stretch-type yarns produced were plied before being processed on the false-twister.

Question: Please detail test procedures for yarn elongation. Were skeins conditioned to obtain maximum contraction before testing?

Mr. Ruppenicker: Stretch properties were determined on serigraph specimens of 40 threads. The test specimens were made by winding the yarns on a seriplane board at the rate of 25 wraps per inch with sufficient tension to hold them in a fully extended position. Tapes were applied 10 inches apart and a 10-inch test specimen was removed from each side of the board. The test specimens were relaxed by "wetting out" and drying, and then allowed to condition at least 24 hours before testing.

Question: You mentioned the term "optimum stretch-type yarn". Would you define or describe an "optimum stretch yarn"?

Mr. Ruppenicker: Optimum stretch-type yarns were selected on the basis of stretch properties, uniformity of texture, strength, and ease of handling. In some cases, maximum stretch had to be sacrificed to improve uniformity by adding more ply twist, etc.

Question: Your data on comparative abrasion resistance of both "false-twist" and "back-twist" (as compared with untreated) was limited to flat abrasion tests and thus substantially influenced by fabric thickness. It is believed that a much more critical area would be in edge abrasion and quite possible in flex abrasion as a function of embrittlement. Have these latter areas of abrasion resistance been investigated?

Mr. Ruppenicker: The stretch-type cotton fabrics have not been tested for either flex abrasion or edge-wear abrasion. In order to test the flex abrasion resistance of highly stretchable cotton fabrics of this type, sufficient tension would be applied to the test specimen to remove all the recoverable stretch. Therefore, under the conditions of this test the fabrics would not be in their normal form. Edge-wear abrasion tests should provide some interesting and useful data. However, an evaluation of the edge-wear abrasion of the stretch-type cotton fabrics has been deferred pending completion of interlaboratory tests for this method conducted by the American Association of Textile Chemists and Colorists.

Discussion following presentation of: "Improving Cotton Cleaning Efficiency with the SRRL Fiber Retriever" by August L. Miller.

Question: In using the terms "high" and "low" with respect to card production at Greenwood, could you identify these rates in pounds per hour?

Mr. Miller: Greenwood Mills did not furnish production rates in lbs./hr., but did indicate that the high rate was substantially above the low.

Question: Please discuss the difference in settings for the M-1 vs. the M-2 plates and obtaining even waste from card to card. Do you recommend the M-1 or M-2 for different applications?

Mr. Miller: The only setting required for the M-1 model is the lickerin screen. The M-2 model also has the intermediate baffle to be set .010" to the lickerin. The settings have little effect on trash removal but are important from the standpoint of fiber loss.

The M-2 model gives a higher percentage of trash removal than the M-1, but is a little more difficult to set and will cost more. The M-2 is recommended where the ultimate in cleaning is desired, and for processes where cleaning is difficult because of the characteristics of the cotton, or type of trash. The M-1 model is probably better for most mill applications because of its simplicity and low cost.

Question: Your remarks on SRRL Retriever on quality were very good. Did you conduct tests on increased production rates? If so, what poundage was produced and what relative quality values were observed? What rate is interpreted as High Production?

Mr. Miller: Research at our Laboratory has been in the normal range of production rates, 10-15 lbs./hr. Tests showed that the cleaning efficiency of the Fiber Retriever was not affected by production rate within this range. The most significant results, however, are those of Greenwood Mills where they apparently worked with higher production rates with no decrease in cleaning efficiency.

Question: Is the Fiber Retriever commercially available? From whom?

Mr. Miller: Two firms are licensed under pending USDA patents to produce the Fiber Retriever: Jenkins Metal Shops, Gastonia, North Carolina, and John D. Hollingsworth on Wheels, Greenville, South Carolina.

Discussion following presentation of: "Improved Techniques for Evaluating Spinning Performance of Cottons" by Louis A. Fiori.

Question: Since strand yarn strength and ends down are not being correlated, is there any relation between the distribution of breaks curve obtained, say on a Uster machine, correlated? Is it possible that time-to-break in testing should be changed?

Mr. Fiori: Changing the time-to-break would merely change the level of strength and elongation, but we still would be limited to the "short" test length. In other words, we would not be testing the points in the yarn which cause an end to break since we are dealing with an infrequent event of one end breaking about every ten miles of yarn. The only laboratory tool we can think of at the moment which might pick up the weak points in the yarn is Cook's continuous yarn tester which tests number of breaks per unit length for a yarn which has been pre-loaded to a certain percentage of the breaking load. There is no assurance, however, that even this instrument, now used successfully in the sewing industry, will do the job.

Also, the yarn strength frequency distribution diagram is restricted by the test length so information derived from this data would not give information of help in predicting ends down in spinning.

Question: Why are bobbins wound with tapered ends if the taper is known to be associated with end breakage?

Mr. Fiori: The tapered end of the yarn bobbin is designed to facilitate winding-off at the winder to avoid yarn sloughing, which thus minimizes waste in the winding operation.

Discussion following presentation of: "Effect of Fiber Length Distribution and Spinning Variables on Yarn Properties and Spinning Performance" by Gain L. Louis.

Question: When studying the effect of spinning draft on end breakage, did you make changes in roving draft only or did you change grain sliver all the way through?

Mr. Louis: The study was designed to evaluate the effect of spinning draft, but slight changes in roving drafts were necessary to obtain the spinning drafts selected for study. All of the rovings were made from the same weight drawing slivers.

Discussion following presentation of: "Changes in Certain Structural and Mechanical Properties of Cotton Cellulose with High Progressive Acetylation" by Carl M. Conrad.

Question: In the thermal analysis of cotton you show that pyrolysis of cotton occurs at about 315° C. Is the temperature at which this occurs affected by such treatments as scouring and mercerization?

Dr. Conrad: We haven't made such studies, perhaps the Chairman (Mr. Schwenker) could answer this.

Mr. Schwenker: No. Scouring and mercerization do not change the temperature at which pyrolysis occurs.

Question: Have you studied the acetylation of yarns of the (false?) twisted type?

Dr. Conrad: No. We used cotton yarn supplied by the Cotton Mechanical Laboratory. All were the same to start with and had a 3 twist multiplier.

Question: It has been shown that crystallization of acetylated cotton takes place at 175° C. How does crystallization affect the strength of the yarn?

Dr. Conrad: Crystallization has been found to be temperature dependent and it does not go to completion at 175° C. The maximum amount of crystallization is obtained at a temperature of about 225° C. Acetylated yarns were heated at 225° C. under vacuum for 10 minutes. After testing it was found that the acetylated yarns had lost nearly 15% of their tensile strength but there was no noticeable loss of elongation.

Discussion following presentation of: "New Triazone Finishes for Cotton Wash-Wear" by Sidney L. Vail.

Question: How do the new alkoxy alkalene triazones compare to the conventional ethyl triazone with respect to CR, tensile strength and efficiency?

Mr. Vail: Our results indicate that the fabrics treated with dimethylol methoxyethyl triazone have higher crease recovery angles than similar fabrics finished with dimethylol ethyl triazone. Comparisons were made using isolated triazones and comparing the results to a dimethylol urea finish. Tensile strengths were about the same. Concerning efficiency, we have not done enough work to establish a reliable comparison. Since improvements are marginal (except for odor control) and the type of agent is conventional, it is suggested that the industry would be in a better position than SU to fully develop and evaluate the finish.

Question: Have you carried any studies on the use of substituted cyanuric acids as finishing agents?

Mr. Vail: No, nor do I know of work of this type being done by others at SU.

Discussion following presentation of: "Post-Irradiation Reactions of Cotton Cellulose" by Florine A. Blouin.

Question: What were the X-ray patterns of the grafted fibers?

Miss Blouin: No X-ray patterns were run on these grafted fibers. This is a good suggestion and such an examination would be of interest in this work.

Discussion following presentation of: "Effects of Tension in Crosslinking Treatments of Cotton Fabrics" by R. S. Orr.

Question: Would the increase in breaking strength due to tension affect the serviceability of shirting materials?

Mr. Orr: We are not close to commercial evaluation of these materials. The article by Hersch, et.al., Harris Research Laboratories, indicated that increased breaking strength would probably increase serviceability of shirts.

Question: Would the decrease in elongation affect serviceability?

Mr. Orr: The increase in stiffness associated with the decrease in elongation usually has a bad effect. Our results are not near commercial practices. Increased stiffness may occasionally have good effects, for instance, in some types of skirts.

Dr. A. E. Brown: (Moderator) Increased breaking strength has good commercial implications. The question arises, who should carry out investigations of service evaluation. The chemical companies do not have the necessary mill facilities.

Discussion following presentation of: "Grafting of Fluoroalkyl Acrylates on Wool" by Allen G. Pittman.

Question: How do the polymers deposited on the wool fiber act to reduce shrinkage, e.g., do they smoothen the fiber surface? Do they produce fiber to fiber bonds?

Dr. Pittman: There has not been sufficient work in this area to give an unequivocal answer on this point. It is probably safe to assume that both scale masking and fiber to fiber bonding play a part in the reduction of felting shrinkage in cases where the preformed fluoroacrylates are applied from a solution.

Question: Has any work been done on the system Diamine + Diacyd Chloride + Cotton? If so, what results were obtained?

Dr. Pittman: No work has been done at the Western Regional Research Laboratory on the system "Diamine + Diacyd Chloride + Cotton" as all our textile work is limited to wool and mohair. It is possible that some exploratory work along this line may have been done at the Southern Regional Research Laboratory.

Question: What effect does the length of time in baths A and/or B have on fiber penetration of the monomer, depth of polymer formation, and crease recovery of the wool fabric?

Dr. Pittman: We assume this question pertains to the Wurlan treatment rather than to the direct application of fluorochemicals. In the Wurlan treatment, increasing time of immersion in the first bath (aqueous diamine solution) from 4 seconds to 40 seconds increases shrinkproofing efficiency somewhat, but the time of immersion in the second (nonaqueous) bath has less effect. The nonaqueous solution wets only the surface of the fiber and there is no evidence of polymer formation in the interior of the fiber. No information is available on the effects of immersion time on crease recovery of wool fabric.

Question: Would you care to comment on the 3-M "oil repellency" test and what it really measures or indicates? Using the 3-M test, how do you

reconcile wetting of the fabric (spreading of drop on surface) with penetration of the fabric (wetting through to underside)? What effect on repellency have you observed with different fabric constructions?

Dr. Pittman: Since both surface tension and vapor pressure of liquids presumably dictate the wetting characteristics of liquids, the 3-M test strictly measures only the oil repellent characteristics toward n-heptane and mineral oil and mixtures of these two miscible liquids. Oil repellency ratings obtained with the test show a good correlation with the resistance of fabrics to oily stains. A more refined technique for determining resistance to staining against a number of specific staining agents has recently been proposed by Collins, Bacon and Smith of DuPont (American Dyestuff Reporter 51 (26), 20, 1962).

I have not experienced a spreading of the test liquid on the fabric with the 3-M test. The test oil either remained as a droplet with contact angle greater than 0° or wetting through to the underside occurred.

I have not studied a wide enough variety of fabrics to say what effect fabric construction has on oil repellency.

Question: Are the fluoroalkyl acrylates restricted to the wool fiber surface or is there penetration and reaction inside the fiber?

Dr. Pittman: The fluoroalkyl acrylates are restricted to the wool fiber surface.

Discussion following presentation of: "Crosslinked Cotton Fabrics Containing Carboxyl Groups" by Austin L. Bullock.

Question: What was the degree of fiber swelling when the crosslinking took place (vapor phase formaldehyde)?

Mr. Bullock: Fibers were under normal laboratory conditions, that is, room temperature and 55-65% relative humidity. Therefore, they had only the normal regain moisture.

Question: What are the "different types of crosslinks" referred to in the presentation?

Mr. Bullock: There is controversy over how formaldehyde crosslinks cotton. There is a question as to whether the crosslinks are intermolecular or intramolecular. There are probably some of both, the conditions of the reaction determining which predominates. Which type occurs or predominates or the fact that crosslinking occurs at all will have to await chemical proof other than that now available.

Question: How were the carboxyl contents of the samples described determined?

Mr. Bullock: A back-titration method was used. The sample is converted to the acid form and soaked in excess standard alkali solution. An aliquot of the standard alkali is then titrated with standard acid and the carboxyl content calculated. To a lesser extent determination by formation of a metal salt has been used. For example, the amount of copper in the copper salt can be determined iodometrically or by X-ray fluorescence.

Discussion following presentation of: "The Crosslinking of Fabrics Woven of Premercerized Yarns" by Alton L. Murphy.

Question: What happens to the residual shrinkages of fabrics woven from yarns mercerized slack and restretched as compared with those woven from yarns mercerized at normal length and with full shrinkage? (Both before and after treatment with DMEU).

Mr. Murphy: An increase in elongation in fabric from yarns mercerized slack and restretched over fabric from yarns mercerized at normal length was observed.

Question: Considering the yarns that were mercerized at 0° C. with 11% NaOH slack and restretched to normal length, how do they compare in breaking strength to those yarns that were mercerized at 25° C. with 22% NaOH?

Mr. Murphy: Higher strength was obtained on gray and scoured yarns mercerized at 0° C. with 11% NaOH.

Question: Was there more shrinkage at 0° C. with 11% NaOH?

Mr. Murphy: Yes.

Question: Is the strength increase acquired by mercerization due to shrinkage or stretching?

Mr. Murphy: Both. Yarns mercerized with full shrinkage, normal length, and with stretch will increase in strength, and fabrics woven from these yarns will increase in strength.

Question: What is the effect of mercerizing the yarns and crosslinking on the wash-and-wear rating of the fabric?

Mr. Murphy: We have not done any work on wash-and-wear rating.

Question: Do the results obtained on fabrics woven with 2 ply yarns correlate with fabrics woven of singles yarns?

Mr. Murphy: If a fabric, woven from singles yarn, was mercerized, you may not get an increase in tensile strength. If a fabric, woven from 2 ply yarn, was mercerized, you would get an increase in tensile strength and after crosslinking the results would be greater for the fabric woven from 2 ply yarns.

Question: Do I understand correctly that the apparent beneficial effect on tensile and tear strengths of the yarn-mercerized fabrics was based on comparisons with similar construction of fabrics which had been neither mercerized in piece or in yarn?

Mr. Murphy: Yes.

Question: If so, how would the comparisons show up of fabrics piece mercerized or fabrics yarn mercerized?

Mr. Murphy: When comparisons were made with the fabric woven from mercerized yarn, there was only a small loss in tensile strength of the crosslinked fabric, in fact only 8% loss.

Discussion following presentation of: "A Progress Report on Stretch Cotton Fabrics by Slack Mercerization" by William G. Sloan.

Question: How does woven, slack mercerized fabric compare to knitted cotton when used as vinyl backing?

Mr. Sloan: We do not have any information on vinyl coated knitted fabrics. It is our understanding that before a knit fabric can be coated, the edges have to be trimmed and there is some loss of material that would not occur with a woven fabric. Coated fabrics having a slack mercerized backing fabric have good stretch properties and we believe they would have better physical properties than coated fabrics with a knit fabric backing.

Question: In obtaining warp and filling stretch of woven goods, what method is used in handling cloth from alkali treatment to washing to prevent warp stretch?

Mr. Sloan: We recommend slack mercerization in a J-box followed by washing in a series of tensionless open width washers. The bottom rolls of these washers should be overdriven to prevent lengthwise tension and the top rolls of the washer and all squeeze rolls should be located just above the water level also to prevent lengthwise tension. A slow processing speed of about 10 yds. per minute is also recommended.

Question: In slack mercerizing for filling stretch, assuming this obtained on conventional mercerizer with tenter chain, what width would you pull 48" greige goods and what percent stretch would you anticipate?

Mr. Sloan: The 48" greige goods would be dried at whatever width they shrank to after mercerization and washing. The percent stretch would depend upon the fabric construction. Many commercial fabrics have 15% easy stretch with good recovery after slack mercerization. The percent stretch will vary usually between 10 and 30% depending upon fabric structure.

Discussion following presentation of: "Phosphorus-Containing Amides as Versatile Finishes for Cotton" by Leon H. Chance.

Question: Do you have data on P percent in fabrics treated with TMCP and TMCPO?

Mr. Chance: No data is yet available on percent phosphorus present in fabrics treated with TMCP and TMCPO.

Question: For the TMCPO reactant, tensile strength retention appeared higher than normal for the crease recovery angle obtained. Was there indication of surface deposits of resin on fiber surfaces?

Mr. Chance: Stiffness is usually an indication of surface deposits of resin, and many times surface deposits increase the tensile strength. No stiffness measurements have been made, but the treated samples did not appear to be any stiffer from visual inspection than those treated with TMCP. At this point one cannot say for sure why TMCPO treated samples had a higher tensile strength retention for a given crease angle.

Discussion following presentation of: "The Preparation and Stability of Cellulosic Derivatives of N-Methylol Hydrazides" by Clifford M. Moran.

Question: Would you expand on why you feel the symmetrically substituted hydrazides retain more nitrogen after hydrolysis than unsymmetrical?

Mr. Moran: We have not done enough work on the hydrolysis of these hydrazide finishes to offer a satisfactory explanation. However, it is known that symmetrical bisamides resist acidic hydrolysis to a greater degree than do the monoamides (unsymmetrical). See Reeves, Vail and Frick, Textile Res. J. 32, 305 (1962).

Discussion following presentation of: "Research Progress on Cotton Batting" by N. B. Knoepfler.

Question: Will mercerization of waste cotton stock increase the "spring" or resiliency of the cotton when used for batting?

Mr. Knoepfler: We have mercerized batting raw stock, then treated the mercerized stock with various cross-linking resins both before and during garnetting. There is a significant difference in hand in the product made from raw stock that has been mercerized but not sufficient difference in the performance of batts made from mercerized raw stock by either of the above procedures to justify further work at this time.

Question: Has waste stock been used as "filler" for reinforced plastics, or as foam plastic filler?

Mr. Knoepfler: I presume that the first part of the question refers to the use of cotton fibers in reinforced plastic laminates. Very little work, as far as we know, has been done in this area. We regret this situation because we feel that the resin

manufacturers have neglected cotton in favor of glass fibers. If an equal amount of work were designed to develop resins specifically for their optimum performance with cotton fibers, cotton would be in a much better position, for example, to compete with glass in filament winding applications. To answer the second part of the question, consideration has been given to the use of blowing agents with the resins and latexes we use in the treatment of cotton batting, and as fillers in foam products. There are problems in both situations. In batting the resins and latexes are diluted to about a total of 20% solids. At this level the viscosity is low, and the film is thin, therefore some of the effectiveness of the blowing agent is lost. In foams the problem is to maintain a fairly uniform distribution of the fibers in the bun. This is complicated by the tendency of the fibers to float toward the top of the bun because the bubbles tend to collect around the fibers.

Question: Is a catalyst used in curing? Have you found any need for an afterwash?

Mr. Knoepfler: Catalysts are used in our process. Selection of the catalyst has much to do with the properties of the products, and in the minimizing of unwanted odors in the finished product. In general, we have found that Magnesium Chloride (hexahydrate) is the best all around catalyst, but even so we use a buffer. Washing of our finished product is impractical.

Question: Have you used needle-punching as a means of creating battings having increased resistance to compression set?

Mr. Knoepfler: We have not used needle-punching as a means of achieving fiber orientation. We feel that the actual number of fibers affected by needling is below 5% of those present in a batt using what we would consider a reasonable number of needles. Furthermore, to be of any real good, the fibers should be needled while the web is wet and tacky which adds to the complications.

Question: Are you working on flame proofing of these battings? The higher the ratio of air to fiber becomes in battings, the greater is the flame hazard.

Mr. Knoepfler: To a degree. As I indicated in my presentation, the work has primarily been directed toward the development of improved resilience and dimensional stability. We have evaluated in a few cases the possibility of rendering the batt flame retardant. APO-THPC works well but the price is too high. THPC in combination with the urea formaldehydes works fairly well but again the price is too high. We have evaluated some of the borates by applying them with compatible latexes. The properties were considered good. We are, of course, aware of the movement by the National Safety Council and others to have bedding furniture and automobile seating made flame proof. Undoubtedly laws will be promulgated in this area, and soon. We hope to be able to work on flame resistance for cotton batting sometime in the near future.

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

Third Cotton Utilization Research Conference

May 2-3, 1963

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